INTERRUPTERS FOR INDUCTION COILS.

It has been thought that an account of the more important forms of interrupter would not be unwelcome to readers of Nature.

A rotating air-break interrupter is shown in Fig. 1. An accurately balanced brass fly-wheel, F W, driven by a small motor, is fitted with two insulating segments, I S, let into its periphery. Bearing on the fly-wheel are two copper gauze brushes, B_1 and B_2; the circuit is interrupted as each brush slips over from the brass to the insulating portion of the rim. It is evident that the arcing which occurs at the break necessitates the use of a fire-proof insulator. A small piece of slate (S in Fig. 1) is fitted immediately behind each brass segment, and this takes the spark; it is easily renewed, the remainder of each insulating segment consisting of vulcanised fibre.

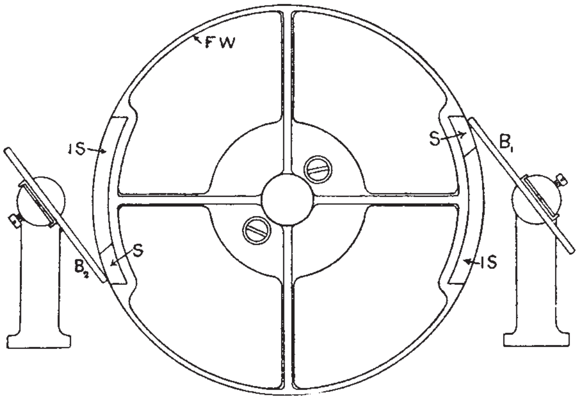

Fig. 1.

So far as the writer is aware, this type of interrupter was first described by Wadsworth in 1894, and was used by Prof. Michelson in some Geissler-tube experiments (*American Journal of Science*, pp. 496–501, December, 1894). As might be expected, the suddenness of the break depends on the speed of the motor (or frequency of interruption). In Fig. 2 are plotted the results of some experiments bearing on this point. It will be seen that for a given value (root-mean-square) of the primary current, an enormously greater spark-length—especially with the larger currents—is obtained at the higher speed.

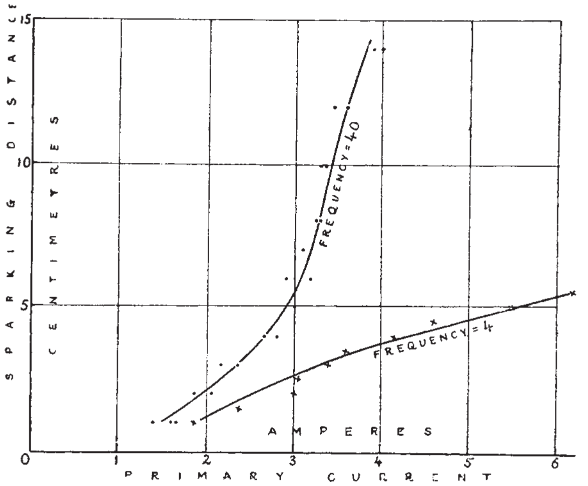

Fig. 2.

This form of interrupter is not very expensive, and works very satisfactorily so long as the primary current does not exceed about 5 amperes. It shares with the platinum interrupter the advantage of cleanliness. Renewals and repairs cost very little, as the only parts which are subjected to any considerable wear are the slate distance-pieces; the rim of the fly-wheel may occasionally require truing-up. It is important to keep the edges of the brass contact-segments and the surfaces of the slate distance-pieces clean by the occasional application of fine sand-paper.

In Fig. 3 are shown the essential parts of the mechanism of a "double-dipper" interrupter. The double motor-driven crank, C, carries two connecting-rods, C R, each of which is attached to a cross-head, C H. Each cross-head is fixed to the top of a stiff rod, R, which passes between the guide-springs, G S, and through the guide-block, G B. The latter is supported by a strong bracket, B, screwed to the stand supporting the motor. Each reciprocating rod ends in an amalgamated copper wire, C W, which dips into the mercury. It will be readily seen that by the adoption of the two-crank arrangement the frequency is doubled for a given speed as compared with the single-crank interrupter; for while with the latter there is only a single break per revolution, the former gives two breaks per revolution, one of the contact-rods or "dippers" entering the mercury shortly after the other has left it. The mercury cup itself is made adjustable in a vertical direction, and is, as usual, immersed in alcohol.

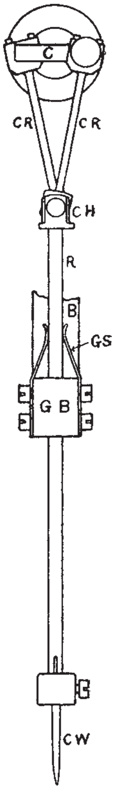

Fig. 3.

The curve marked "double dipper" in Fig. 4 gives the results of a test with this form of interrupter. The frequency of interruption was 22. The results correspond fairly well with those plotted in Fig. 2 for the rotary air-break interrupter at a frequency of 40.

This type of interrupter is comparatively cheap and simple, and works very steadily. There is no complicated mechanism to get out of order, and only a small quantity of mercury is required (about 2lb.).

One of the most successful types of rotary interrupter is the mercury jet interrupter. Several varieties of this have been used. One of the best known is shown in Fig. 5. The vertical motor-driven shaft, S, carries a cylinder, C, the lower portion of which is cut up into a number of teeth, T. The shaft S is continued downwards, and passes through the mercury pump casing. The mercury pump is of very simple construction, and is shown in Fig. 5 (*b*). Inside a flat oval box, which forms the pump casing, are arranged two thick toothed wheels. One of these is mounted on the lower end of the shaft S, which carries the toothed cylinder, Fig. 5 (*a*), and drives the other. The wheels fit the inside of the casing very closely, and are arranged to rotate as indicated by the arrows in Fig. 5 (*b*). The mercury imprisoned between the teeth of the wheels and the casing is consequently carried round and forced through the nozzle. The issuing fine jet of mercury, M J—Fig. 5 (*a*)—is directed against the rotating teeth, the break taking place at the vertical edge of a tooth. The height of the nozzle N is adjustable, and by this means the magnitude of the current may be regulated, as by raising the nozzle the jet will be directed against a tooth for a longer period, and the current will attain a larger value before the break takes place. The entire mechanism of this interrupter is contained in a strong cylindrical glass vessel, the lower portion of which contains mercury, in which the pump is immersed, and with which the pump chamber freely communicates by means of a suction orifice, while above the mercury is the usual alcohol filling the bulk of the vessel.

If in good working order, the mercury jet interrupter gives excellent results, as may be seen by referring to the curve marked "mercury jet" in Fig. 4, which corresponds to a frequency of interruption = 40. A comparison of this curve with that given in Fig. 2 for the rotating air-break interrupter at once shows the superiority of the jet interrupter. The mercury jet interrupter is much more expensive and complicated than the "double-dipper" type, and requires a larger amount of mercury; but it yields somewhat better results.

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In Fig. 6 is shown the Wehnelt interrupter. A large rectangular glass vessel containing dilute sulphuric acid is fitted with an ebonite cover, E C, which supports the electrodes. The terminal T_2 is in connection with the lead plate, L P, which forms the kathode. The bridge-piece, B, supports two rack rods, R, and the anode terminal T_1. Each rack rod is geared with a pinion by means of which it may be raised or lowered as required, M H being the milled heads for turning the pinions. The rack rods are continued downwards in the form of thinner rods encircled by glass tubes, G T, and finally end in stiff platinum points, P P, around which the tapered ends of the tubes fit very closely. By raising or lowering either anode, a smaller or greater surface of it may be exposed to the surrounding electrolyte. The density of the acid depends on the voltage at which the interrupter is to be supplied. The interrupter is connected in series with the primary of the induction coil, and, if necessary, with an additional self-inductance. As soon as the circuit is closed, and provided the area of anode surface exposed to the electrolyte is not excessive, and the self-inductance not too small, the interrupter begins to act. A pink glow appears around the extremities of the anodes, the interrupter emits a loud note of definite pitch, and a shower of sparks is produced across the space between the secondary terminals of the coil. Bubbles of gas rush up each glass tube, G T, the electrolyte rises in each tube, and may overflow through the side openings, O.

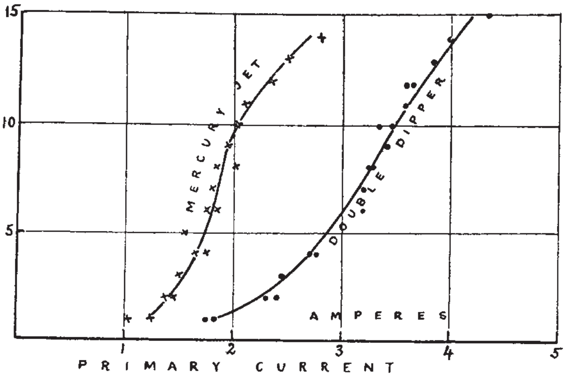
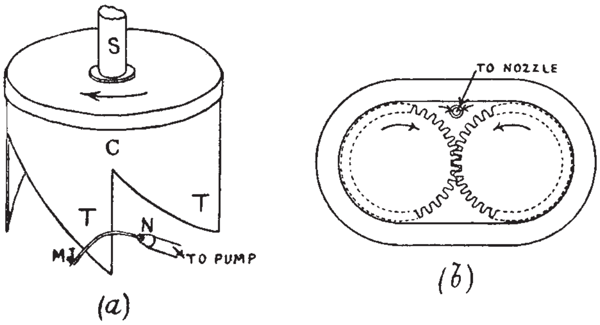


Fig. 4.



(a)

(b)

Fig. 5.

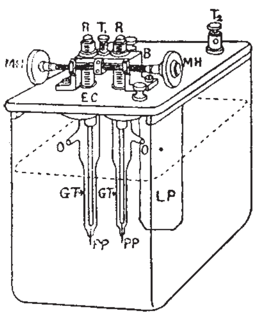
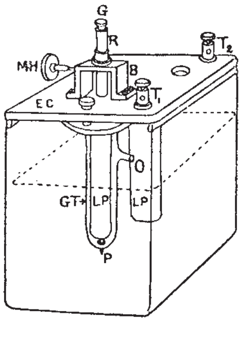


Fig. 6.



Fic. 7

Another form of electrolytic interrupter, originally due to Caldwell, but subsequently improved and modified in various ways by others, is shown in Fig. 7. The terminal T_2 is, as in the Wehnelt interrupter, connected to a lead plate. But instead of a platinum anode, a lead plate is also used for the other electrode. This second lead plate is surrounded by a glass tube, G T, which completely separates it from the remainder of the electrolyte except for a small perforation at the bottom of the tube, through which passes the pointed end, P, of a long glass rod, G, supported in a tubular rack rod, R, which may be raised or lowered by means of a pinion fitted with the milled head, M H. The area of communication between the electrolyte in the tube and that outside is controlled by raising or lowering the conical glass plug. Either electrode may be used indifferently as anode or kathode. The break takes place at the perforation of the glass tube.

In conclusion, thanks must be expressed to Mr. A. C. Cossor, of 54 Farringdon Road, E.C., who very kindly provided an induction coil and a number of interrupters required to carry out the tests recorded in this article.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

It is stated that Sir William MacDonald, of Montreal, has decided to give 800,000*l.* toward the erection of a normal school at St. Anne de Bellevue, a few miles distant from Montreal, and the erection and endowment of an agricultural college at the same place.

There is no sign of diminution in the interest shown by public authorities and by private benefactors for higher education in the United States. We learn from *Science* that by the will of Mrs. Stanford about 400,000*l.* is bequeathed to Leland Stanford Junior University. The university also comes into possession of the house built by Senator Stanford at San Francisco and its contents, which are valued at more than 400,000*l.* The legislature of North Carolina has appropriated 10,000*l.* for the erection of a chemical laboratory at the University of North Carolina.

We have received a copy of the prospectus of courses of instruction in poultry-keeping held at University College, Reading, and the college poultry farm at Theale. The farm, which is of about 40 acres, largely meadow land, is used also as an experimental station. The courses are of varying lengths and different degrees of difficulty to meet the requirements of all grades of students. The practical work is exhaustive, and due attention is given to kindred technical subjects such as carpentry. It appears that this branch of the work of the college has had an important influence on the development of scientific poultry-keeping in Berkshire and neighbouring counties.

A strong committee has been formed for the purpose of securing suitable conditions of work, and providing opportunities for development, of Bedford College for Women in London. An appeal to the public on behalf of the college has just been issued. The college, which is a school of the University of London, must before long come to an end unless it can obtain a large amount of public support. A freehold site and a new building are essential, and it is estimated that their cost may amount to 150,000*l.* Experience has shown that the fees of the students and the allotted share of the Treasury grant to university colleges are not sufficient without considerable additional support to carry on the higher education supplied by the college, the cost of which is constantly increasing. To make the work of the college fully effective, it is therefore desirable to obtain further endowment to the extent of 100,000*l.*, or the equivalent income. The Senate of the University of London has shown approbation of the scheme for re-

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